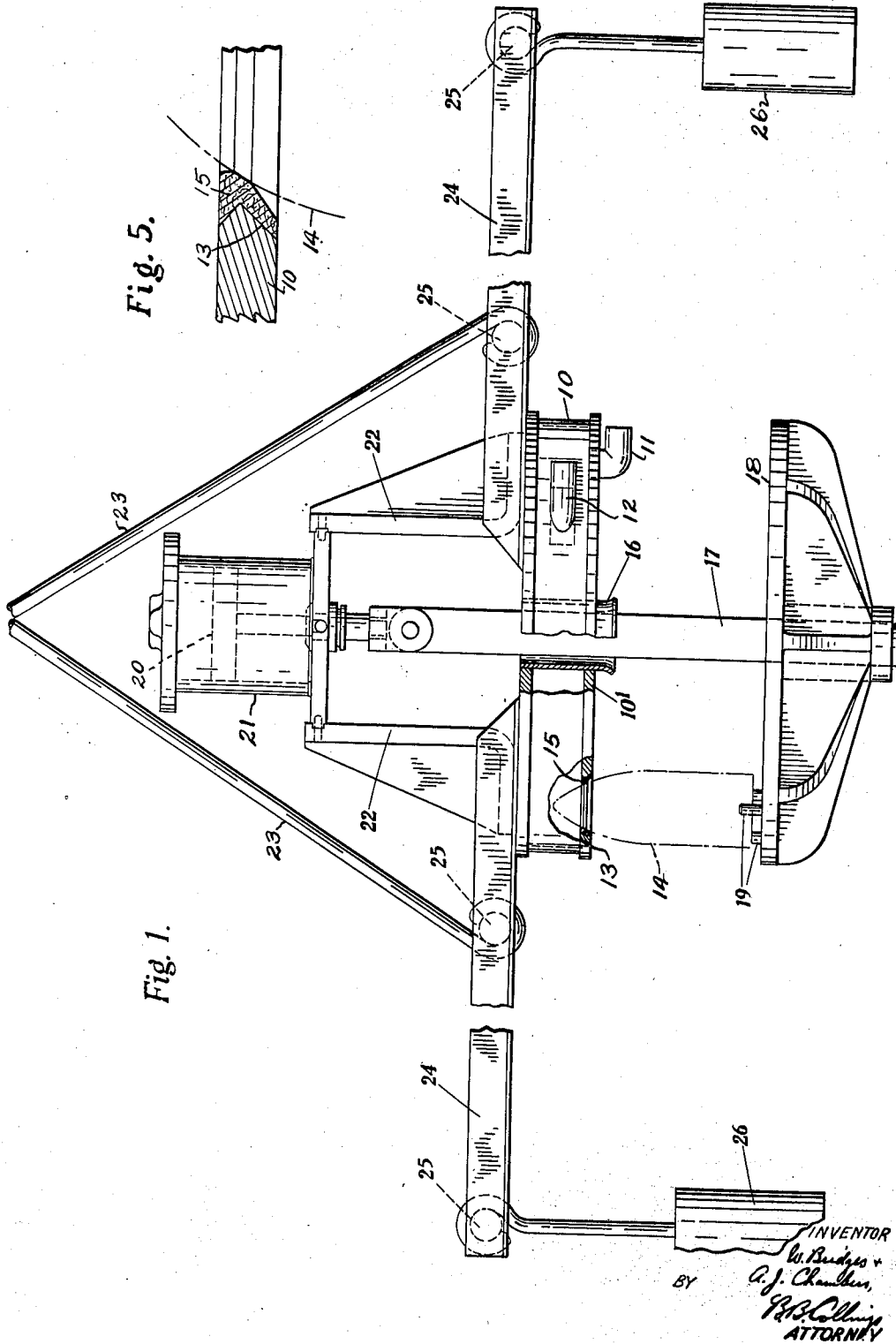


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OF ARMOR PIERCING PROJECTILES  
Filed Feb. 11, 1941

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2 Sheets-Sheet 1



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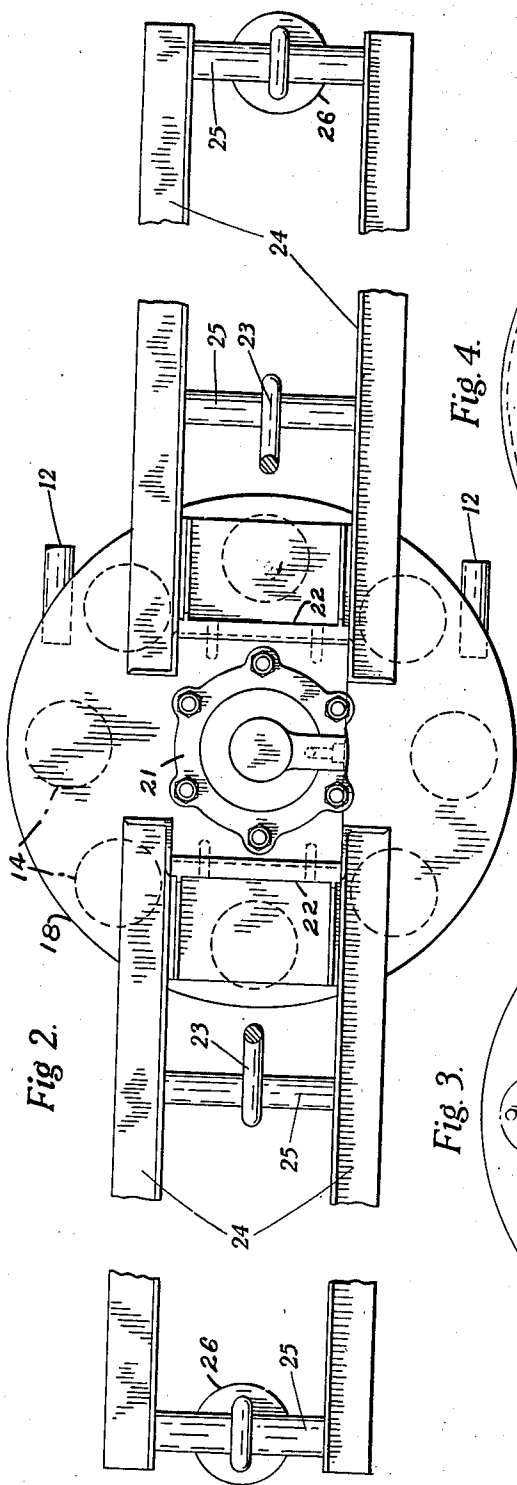


Fig. 2.

Fig. 4.

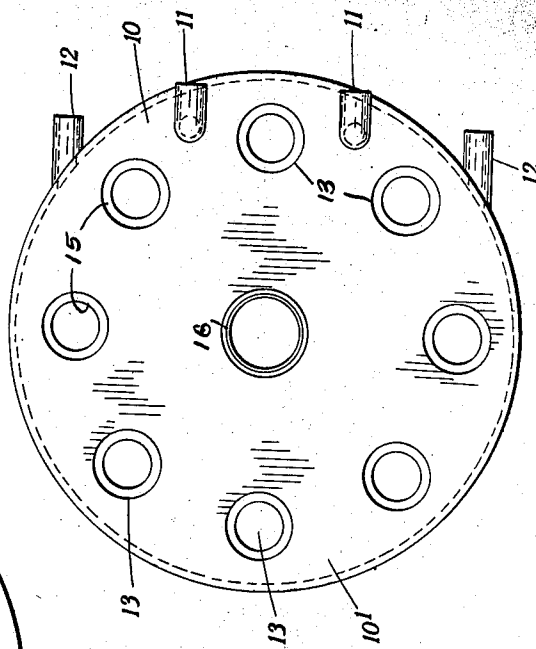
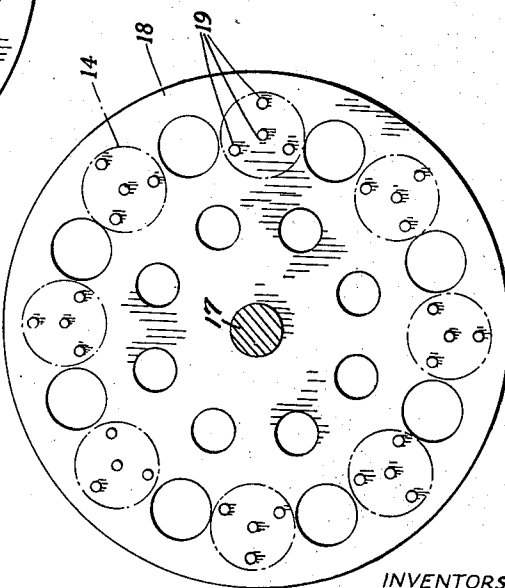


Fig. 3.



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## UNITED STATES PATENT OFFICE

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APPARATUS EMPLOYED IN THE HARDEN-  
ING AND TEMPERING OF ARMOR PIERC-  
ING PROJECTILES

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In Great Britain December 30, 1939

5 Claims. (Cl. 266—4)

This invention is for improvements in and relating to apparatus employed in the hardening and tempering of armor piercing projectiles. At one stage of the hardening and tempering process it is necessary to submit the heated projectiles to a molten lead bath while at the same time cooling the noses thereof. In order to effect this operation the shells are inserted in a device which consists of a cooling drum having its under wall pierced with apertures to receive the shell noses, and a tray or support on which the bases of the shells rest, this tray or support being forced toward the drum by means of wedges so that the shell noses are urged into the apertures. Cold water is circulated in the drum to chill the shell noses, while the device is lowered into a lead bath so that the molten lead makes contact with the bodies of the shells. Since the framework of the device is also heated by the molten lead, various dimensional changes take place therein which result in the wedges slackening off so that water-tight joints are no longer obtained at the entry of the noses into the drum and the cooling water escapes on to the molten lead. This is a disadvantage which the present invention seeks to obviate.

This invention provides a device for use in the heat treatment of shells, comprising a cooling chamber having a wall pierced with apertures for the reception of the noses of the shells, leaving the lower portions of the shells exposed, and means for resiliently urging the shells into said apertures. It will be appreciated that since a resilient force is exerted the dimensional changes hereinbefore referred to will not adversely affect the efficiency of the joints around the shell noses, and the escape of the cooling water will be obviated. The invention also includes a device for use in an operation in the heat treatment of shells wherein the noses and the bodies of the shells are subject to different temperatures, comprising a fluid chamber a wall of which is provided with apertures for the insertion of the shell noses, and means for maintaining a pressure on the shells urging their noses into the apertures, so as to maintain fluid tight joints thereat irrespective of dimensional variations in the device itself, and/or the shells, due to temperature changes during the conduct of the operation.

The foregoing and other features of the invention set out in the appended claims are embodied in a preferred form of the device, intended for the lead bath treatment of armor piercing projectiles during the hardening and tempering

process, which will now be described in detail by way of example with reference to the accompanying drawings, in which

Figure 1 is an elevation of the device, partly in section;

Figure 2 is a plan thereof;

Figure 3 is a plan of a projectile-supporting tray included in the device, while Figure 4 is an inverted plan of the fluid chamber aforesaid; and

Figure 5 is an enlarged fragmentary sectional view illustrating one form of packing means for the projectile-receiving apertures of the cooling drum.

The illustrated device comprises a shallow cooling drum 10 having inlets and outlets 11, 12, for cooling water. The flat bottom wall 10' of this drum 10 is pierced with a plurality of apertures 13 suitably spaced and of a suitable diameter to accommodate the tapered noses of the projectiles (14, Figs. 1 and 3), and these apertures are conveniently edged with asbestos or other jointing material 15 which has the necessary heat-resisting and water-tight properties.

A sleeve 16 extends axially through the centre of the drum 10, thereby providing a passage for a central rod 17 which at its lower end supports a tray 18. This tray is suitably ribbed for strength and at its upper surface may be provided with means (e. g. pins 19, the central one of which may enter a hole in the base of the projectile, like a dowel) for supporting and locating projectiles 14 thereon in such manner that their noses are adapted to register with the apertures 13 provided for their reception in the underside of the drum 10.

At its upper end the central rod 17 is attached to the piston 20 of a pneumatic cylinder-and-piston device, the cylinder 21 of which is connected rigidly to the cooling drum 10 by connections 22. It will therefore be appreciated that after the shells 14 have been assembled on the tray 18, by operation of the pneumatic device, the tray is caused to approach the drum so that the noses of the shells are forced hard into the apertures 13. The pressure thus exerted by the pneumatic arrangement is resilient and therefore even though the central rod 17 supporting the tray 18 may expand when it is brought into contact with the molten lead, fluid tight joints are still maintained around the shell noses.

The device is provided with suitable lifting tackle 23 whereby it may be raised and lowered in its retraction from and immersion in a lead bath. It is also desirable to provide means where-

by the weight of the device and its charge of shells may be controlled so as to overcome buoyancy. To this end a pair of parallel beams 24 project, at each of two diametrically opposed locations, beyond the periphery of the cooling chamber 10. Each pair of beams is connected by transverse members 25. One such transverse member in each pair of beams serves for the attachment for the lifting tackle 23. Another such member, located beyond the edge of the lead bath, serves for the suspension of a weight 26. These weights 26 are provided to counteract the buoyant effect of the molten metal bath upon the apparatus and therefore do not enter the lead bath when the device itself is lowered into it.

It will be understood that instead of the tray or support 18 being movable towards and away from the chamber 10 by the arrangement 20, 21, the chamber may be movable towards and away from the support, and when reference is made in the appended claims to movement of the support towards and away from the chamber this expression is to be construed broadly to mean relative movement of said two elements and to include movement of the chamber towards and away from the support.

We claim:

1. Apparatus for use in an operation in the heat treatment of shells wherein the nose portions and the body portions of the shells are subject to different temperatures, comprising a chamber for containing a heat-exchange fluid, said chamber having a wall provided with apertures; a support for the shells; and a single means for moving said support toward said chamber to introduce the nose portions of the shells through the apertures to be acted upon by the heat-exchange fluid in the chamber, and for maintaining a yielding engagement between other portions of the shells and the perimeters of the apertures, whereby to prevent escape of the heat-exchange fluid through said apertures irrespective of dimensional changes in the parts resulting from temperature variations.

2. Apparatus for use in an operation in the heat treatment of shells wherein the nose portions and the body portions of the shells are subject to different temperatures, comprising a chamber having a bottom wall provided with apertures; packing rings surrounding said apertures; means for admitting and exhausting a heat-exchange fluid to and from said chamber; a shell support below said chamber, movable toward and from its bottom wall; and fluid-pressure means for moving said support toward said wall to project the nose portions of the shells through its apertures to be acted upon by the heat-exchange fluid in the chamber, said fluid-pressure means also maintaining a yielding engagement between other portions of the shells and the packing rings surrounding the apertures, whereby to prevent the escape of the heat-exchange fluid through said apertures irrespective of dimensional changes in the parts resulting from varying temperatures.

3. In apparatus for the heat treatment of shells or similar work pieces through immersion of said shells or work pieces and at least a portion of said apparatus in a fluid heating medium, a sup-

port for the work pieces; a chamber for a cooling medium spaced from said support, said chamber having a wall facing the support which is provided with apertures through which portions of the work pieces may be presented to the cooling medium within the chamber; means for effecting relative movement between the support and chamber to introduce said work piece portions into said apertures and to maintain yielding engagement between the surfaces of the work pieces and the perimeters of the apertures whereby to prevent leakage of the cooling fluid regardless of dimensional changes in the parts resulting from temperature variations; and means for effecting immersion of the exposed portions of the work pieces and at least a portion of the apparatus in the heating medium.

4. In apparatus for use in the heat treatment of shells or similar projectiles through immersion of said shells or projectiles and at least a portion of said apparatus in a molten metal bath, a support for the bases of said projectiles; a chamber for a cooling fluid spaced from said support, said chamber having a wall facing said support which is provided with apertures through which the nose portions of the projectiles may be presented to the cooling fluid within the chamber; means for effecting relative movement between the support and chamber to introduce said nose portions of the projectiles into said apertures, said means thereafter also maintaining a yielding engagement between the surfaces of the projectiles and the perimeters of the apertures to prevent escape of the cooling fluid therebetween to the molten bath due to dimensional changes in the parts induced by temperature variations; and means for raising and lowering the support, chamber, projectiles and moving means to effect immersion of the exposed portions of the projectiles and at least the support in the molten bath.

5. In apparatus for the heat treatment of projectiles, of the kind capable of being lowered with its charge of projectiles into a fluid bath in a heat treatment process wherein the noses and body portions of the projectiles are subject to different temperatures, the said body portions being exposed to the fluid of said bath, the combination of a drum for the circulation of a nose-cooling fluid, said drum having top and bottom walls and a passage way leading through the drum from one wall to the other, said bottom wall being provided with nose-receiving apertures spaced around the passage way for exposing inserted noses of the projectiles to the cooling fluid; a projectile support below the drum; a fluid-operated piston-and-cylinder device above the drum, for causing the drum and support to approach one another to enter the projectile noses in the apertures and for maintaining a fluid pressure pressing said noses into the apertures irrespective of dimensional changes due to temperature variations; and connections between said device and the drum and the support, which connections include a tension connection extending to the support through the passage way.

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